PCB CONCENTRATIONS IN SOIL AND GRASS SAMPLES IN THE VICINITY OF CHEMICAL WASTE MANAGEMENT, SMITHVILLE - 1985

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DAVID BALSILLIE, Director
Air Resources Branch

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DATE:	*February, 1986*
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PCB Concentrations in Soil and Grass Samples in the Vicinity of Chemical Waste Management, Smithville - 1985

On September 14, 1985, members of the Phytotoxicology Section collected soil and grass samples from 15 stations in the vicinity of Chemical Waste Management, a PCB storage site in Smithville. The sampling was requested by Mr. Nick Ehlert of the MOE Hamilton office, in response to public concern regarding possible PCB contamination of agricultural land. Also, a municipal water supply is located approximately 500m south of the PCB storage compound, and there was some apprehension among area residents that PCB's may be migrating toward the well.

A description of the samples collected is contained in Table 1, and locations of sampling stations are shown on Figure 1. A copy of the Phytotoxicology Section soil sampling protocol for PCB's is appended. The soil sampling process used at Smithville was the same as that given in the protocol in all significant aspects. Regarding grass sampling, the sample containers utilized and the method of cleaning equipment between sites were essentially the same as for soil.

Results

The PCB concentrations in the soil and grass samples are shown in Table 2, and the surface soil and grass results are further illustrated in Figure 2.

INTERNATIONAL YOUTH YEAR 1985
ANNÉE INTERNATIONALE DE LA JEUNESSE 1985

PCB concentrations in both surface soil and grass were elevated in the immediate vicinity of the storage compound. However, only one soil sample (Station 9) contained PCB's in excess of the 50 ug/g hazardous waste guideline. This location was visibly oil stained and the contamination was probably from a localized spill. Soil contamination decreased with increasing distance west, east and south of the compound. Soil concentrations were below the detection level of 0.1 ug/g at four stations located 90m and further south of the storage area, indicating that contamination did not extend to the municipal well.

PCB concentrations in two sub-surface soil samples (30 - 40 cm depth) collected near the elevated storage platform at the southeast corner of the compound were 0.29 and 0.55 ug/g, vs. 6.6 and 4.4 ug/g in surface soil at these respective locations (Table 2).

Grass samples also showed decreasing PCB levels with distance from the Chemical Waste Management yard. The highest level measured was 6.0 ug/g (fresh weight) in grass from Station 5, along the southeast wall. A detectable concentration of 0.03 ug/g (detection limit 0.02 ug/g) was found in the sample collected at Station 3, approximately 190m south of the compound. Since studies have generally shown that vegetation does not take up PCB's from contaminated soil to a significant degree and transport them to above-ground parts, the presence of up to 6.0 ug/g in grass may indicate aerial deposition (possibly even surface splash at Station 5, although there was no visible oily residue on the grass), due perhaps to leakage (volatilization) from the Chemical Waste Management storage yard.

Of the four stations for which PCB concentrations in grass were obtained, only for Station 5 (6 ug/g in grass) did the PCB arochlor mixture in the grass match that in the soil. The absence of a match at the remaining three stations may be taken as evidence that the PCB in grass was not due to uptake from soil. However, it also is possible that the arochlor "signature" became distorted due to chemical transformations within the vegetation (if soil uptake had occurred) or due to interference from natural organic compounds.

Table 1 - *Description of PCB sampling locations at Chemical Waste Management Ltd., Smithville - September 4, 1985*

Station No.	Location	Samples Collected
1	- oily depression at SW corner of PCB storage compound	- surface soil (0-5 cm depth)
2	- oil stained area on N side of gate, 9m N of Sta. 1	- surface soil
3	- hay field, 190m S of PCB storage compound near shrubby mound, approx. 2/5ths of way between compound and municipal well	- surface soil and grass
4	- hay field, 90m S of PCB storage compound	- surface soil and grass
5	- S side of concrete platform, near SE corner of compound (60 ppm PCB detected here in earlier surface soil sampling)	- surface soil, sub-surface soil (30-35 cm) and grass
6	- oil stained area along E fence, 12m N of SE corner	- surface soil, sub-surface soil (35-40 cm) and grass
7	- weedy field, 45m E of compound, near woodlot	- surface soil
8	- wet depression, NE corner of compound	- surface soil
9	- oil stained area midway along S side of roadway, W of compound	- surface soil
10	- oil stained, crusted area 10 m E of bern (crust not sampled)	- surface soil
11	- shallow depression between berm and roadway	- surface soil
12	- around test well, 30m S of compound	- surface soil
13	- confluence of drainage depressions, 12 m S of compound	- surface soil
14	- ditch, N side of road, immed. N of municipal well	- surface soil
15	- base of sodded mound, N edge of municipal well	- surface soil

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Table 2

PCB concentrations in soil and grass samples collected from the vicinity of Chemical Waste Management, Smithville - Sept. 4, 1985

Station No.	Sample Description	PCB Concentration*
1	Soil (0-5 cm)	4.3[a]
2	Soil (0-5 cm)	22.0[b]
3	Soil (0-5 cm)	< 0.1
"	Grass	0.03[d]
4	Soil (0-5 cm)	< 0.1
"	Grass	0.13[d]
5	Soil (0-5 cm)	6.6[a]
"	Soil (30-35 cm)	0.29[a]
"	Grass	6.0[c]
6	Soil (0-5 cm)	4.4[a]
"	Soil (35-40 cm)	0.55[b]
"	Grass	0.665[d]
7	Soil (0-5 cm)	0.15[b]
8	Soil (0-5 cm)	0.88[a]
9	Soil (0-5 cm)	130.[b]
10	Soil (0-5 cm)	2.2[a]
11	Soil (0-5 cm)	< 0.1
12	Soil (0-5 cm)	2.1[b]
13	Soil (0-5 cm)	2.8[c]
14	Soil (0-5 cm)	< 0.1
15	Soil (0-5 cm)	< 0.1

* Soil concentrations are ug/g, dry weight
Grass concentrations are ug/g, fresh weight

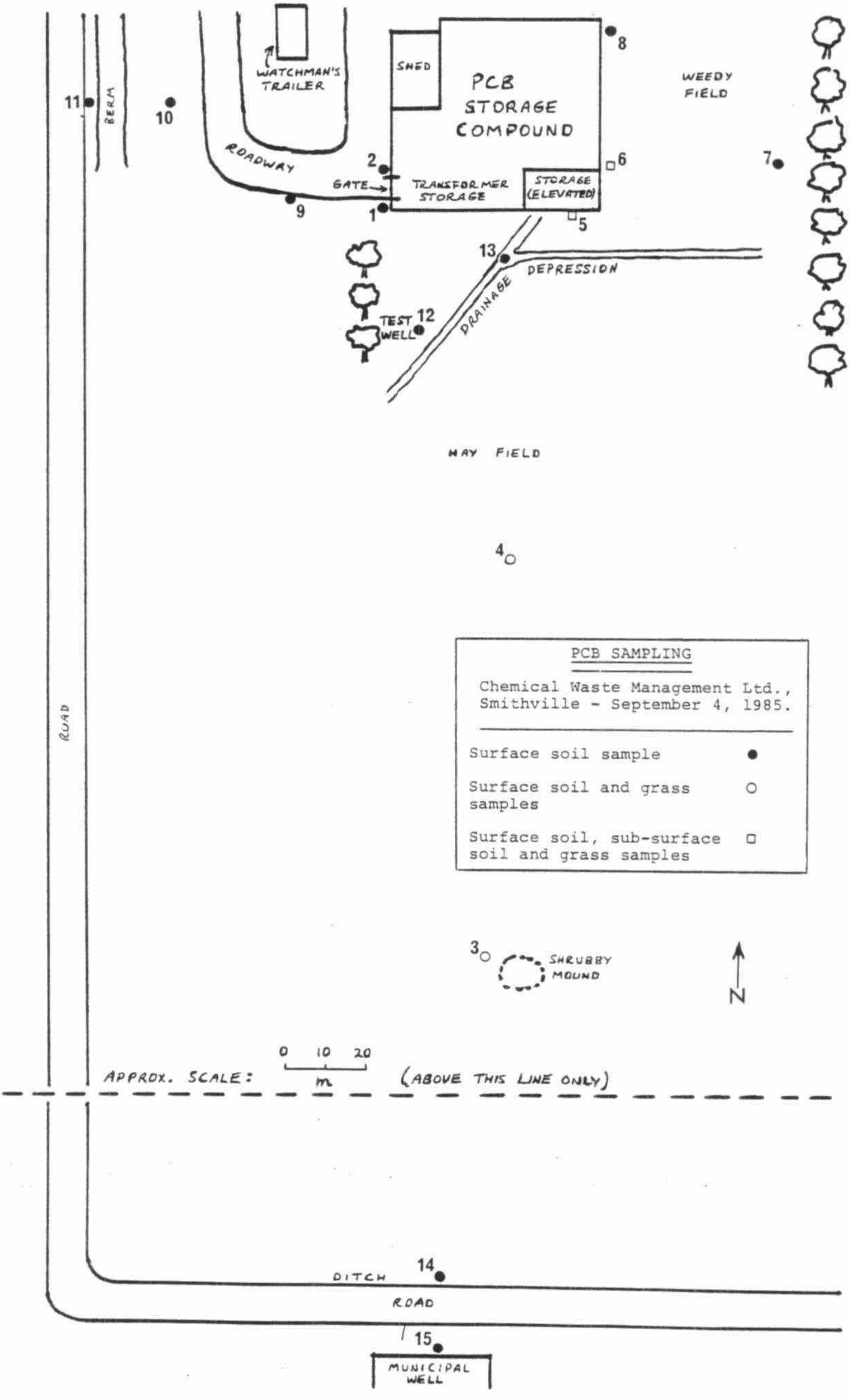
a = resembled mixture of Aroclor 1248 and 1260

b = resembled Aroclor 1260

c = resembled mixture of Aroclor 1254 and 1260

d = resembled mixture of Aroclor 1242 and 1260

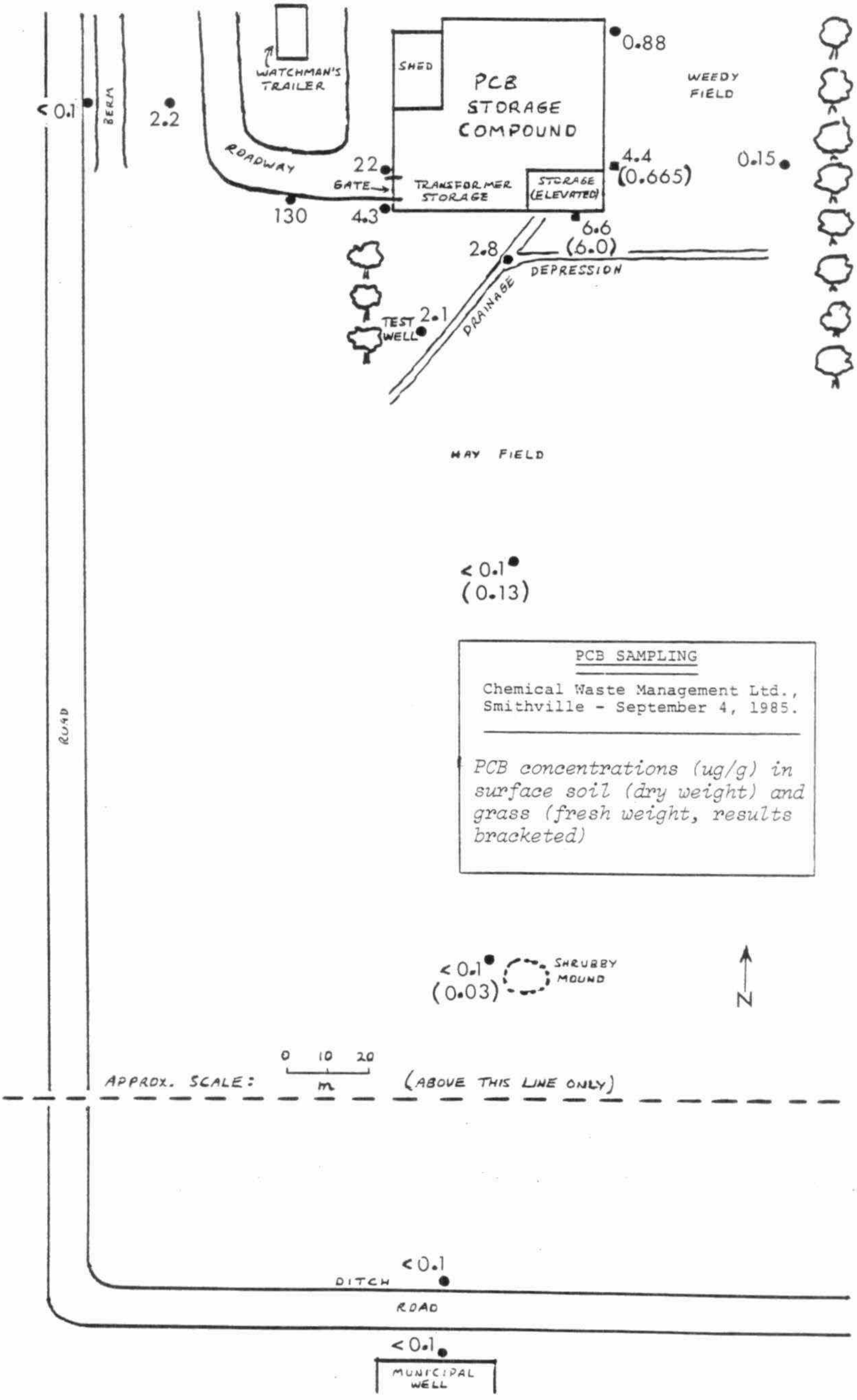
FIGURE 1



PCB SAMPLING

Chemical Waste Management Ltd., Smithville - September 4, 1985.

FIGURE 2


PCB SAMPLING

Chemical Waste Management Ltd.,
Smithville - September 4, 1985.

PCB concentrations (ug/g) in surface soil (dry weight) and grass (fresh weight, results bracketed)

APPENDIX

Soil Sampling Protocol for Polychlorinated Dibenzo-p-Dioxins (PCDDs), Polychlorinated Dibenzofurans (PCDFs) and Polychlorinated Biphenyls (PCBs)

Phytotoxicology Section
Air Resources Branch

The following sampling protocol was designed to be used by Phytotoxicology investigators for collection of soil which is to be analyzed for PCDDs, PCDFs or PCBs. Although personal safety must always be the ultimate concern when sampling for toxic substances the sampling sequence outlined in this protocol is primarily designed to minimize cross contamination and therefore ensure sample integrity. It is based on information provided by the Missouri and Ohio offices of the U.S. EPA and adapted to be compatible with existing Phytotoxicology sampling technology. It has been reviewed and accepted by the MOE Dioxin Laboratory.

1. Material and Equipment

The basic sampling tool is the standard split-tube chrome-plated or stainless steel soil corer (available from Canadian Forestry Equipment Ltd.) used for regular Phytotoxicology soil sampling. The corer must be in new condition. If the chrome plating becomes chipped or flaked during sampling, the corer should be discarded in favour of a new one. The corer is used to sample lawns and other sodded areas or wherever the soil is not prohibitively coarse or compact. At sites which are not conducive to use of a soil corer (e.g. gravel parking lots), a stainless steel soup spoon or a chrome plated indoor gardener's shovel are acceptable substitutes. As with the soil tube, the spoon/shovel must not be visibly scratched or otherwise damaged so that soil particles will not become lodged in the tool's surface and resist the washing procedure.

Additional equipment includes:

- *disposable PVC gloves*
- *plastic sample bag used for regular Phytotoxicology field samples*
- *heavy mill "green garbage" bag*
- *tinted PCB/pesticide solvent-rinsed glass sample jars with foil lid liner*
- *insulated plastic or metal picnic cooler with a hinged lid which can be latched*
- *biohazard stickers or other suitable warning labels*

- *Phytotoxicology field numbers and forms*
- *bristled bottle brush and sponge*
- *several litres of distilled water in a pouring container*
- *several litres of distilled water/alconox solution in a pouring container*
- *95% denatured alcohol in a spray bottle*
- *1,1,1-trichloroethane or similar organic solvent (e.g. n-hexane) in a spray bottle*

2. *Defining the Survey Area*

Abatement officers or other authority requesting the sampling should be consulted and the survey area precisely defined. Control sample criteria should be established. For example, if an urban area is to be sampled then control samples should be collected from outside the deposition/spill zone but within the same metropolitan, regional or municipal area. The importance of good comparative control samples is emphasized and it is suggested that a "remote" control sample also be considered. However, it should be kept in mind that most municipal land and cultivated farm properties have probably been sprayed with organochlorine based pesticides or possibly with sewage sludge in the past and these treatments may have contained PCDD or PCB compounds

Pre-determine the exact number of sample sites and the number of replications per site and ensure that enough equipment is available to complete the survey. As is the case with sampling for other types of contaminants, replicated sampling to establish the extent of site variability is the preferred method. However, in most cases constraints on the number of samples which can be handled by the analytical laboratory will determine the number of replicates which can be incorporated into the sampling plan.

3. *Prioritizing and Defining each Sample Site*

The first and most logical step towards limiting sample cross contamination is to sample from the least contaminated site first and proceed through the progressively more contaminated locations. Obviously this requires a speculative fore-knowledge of the contamination gradient. The abatement officers should be able to provide insight as to the projected deposition pattern if a stack source is the object of the survey and field observations should determine flow directions in the case of a spill. Accordingly, the investigator should prioritize the sample sites, from the least to most contaminated, and prepare to conduct the survey in that order.

The actual sample site may be a large school yard, a farmer's field or a small vegetable garden in the city. This presents the usual problem of collecting a representative sample. Large areas may require a grid and random numbers selection; smaller sites may be representatively sampled with an "m", "x', "w" or "z" walking/collection pattern. The investigator must decide on a practical but representative technique at each site.

4. Sample Collection

Sample collection should be conducted with two people, only one of whom actually handles the sampling tool and the soil. This prevents the potentially contaminated soil from contacting the outside of the sample jar and other equipment. In the following outline of the actual sampling procedure, the field personnel are identified as Investigator 1 and Investigator 2. Investigator 1 will collect the soil and Investigator 2 will assist. In cases where it is not possible to have two investigators, the following procedures will have to be followed in a sequence that logically minimizes the possibility of soil coming in contact with the outside of the sample jar and other field equipment or notes.

- *Upon arrival at the site, the decision is made as to which sampling design will be employed (grid, "m", "x", "w" or "z" etc.) and Investigators 1 and 2 are designated.*
- *Investigator 2 labels all sample jars, prepares all appropriate field and sample identification forms and makes a sketch of the property showing the location of the sample points.*
- *Both investigators put on PVC gloves (and any other personal safety equipment required for complete protection)*
- *Investigator 2 opens the cooler and lines it with a green garbage bag.*
- *Investigator 1 proceeds with sample collection as follows:*
    - *1 replication per sample jar, composed of 15 to 20 soil cores, or spoon/shovel scoops 0 to 5 cm depth (unless otherwise requested),*
    - *the jar should be filled approximately 3/4 full.*
- *When the sample has been collected, Investigator 2 screws on the jar lid and places the numbered jar inside the plastic garbage bag inside the cooler.*
- *Investigator 1 scrubs (with brush/sponge) the sampling tool visibly clean and holds it so that Investigator 2 can pour the distilled water rinse over it.*
- *Investigator 1 holds the sampling tool so that Investigator 2 can spray with 95% denatured alcohol until tool is dripping.*
- *Spraying is repeated in a similar manner with 1,1,1-trichloroethane.*
- *Investigator 1 places sampling tool in clean plastic bag for use at next site.*

- *Investigator 2 places all remaining equipment back in vehicle and gloves from both investigators are removed and placed in a plastic bag for disposal.*

High resolution (low ppt) isomer specific detection requires laboratory-clean sample tools for each sample. The washing procedure is time consuming, but it is of paramount importance to the success of the sampling program. Depending on the sample location and the degree of suspected contamination, the wash/rinse material and the waste gloves can either be disposed of on return to the processing laboratory or containerized and returned to the main analytical laboratory for disposal.

5. *Storage and Delivery of Samples*

PCDDs, PCDFs and PCBs are believed to be photodegradable, but otherwise extremely residual in soil. Only tinted PCB/pesticide solvent-rinsed glass jars with foil lid liners should be used for sample storage. The samples should be placed in the cooler immediately, the plastic liner bag closed and secured, and the cooler lid latched before proceeding to the next sample site. The cooler should be labelled with biohazard stickers and closed when sampling has been completed. The cooler should be kept out of direct sunlight and refrigerated if extended storage is necessary. Laboratory extraction of the soil should be conducted within 90 days of sampling.

The latched and labelled cooler should be delivered to the sample reception area of the Main Laboratory (MOE) as soon as practically possible on completion of the survey.

6. *Safety Considerations*

The only personal safety precaution mentioned thus far in this outline is the use of PVC gloves. At a severely contaminated spill or dump site, additional safety gear should be worn. This may include disposable boots or a complete disposable outer wear suit. Breathing apparatus may even be required. With the exception of the breathing equipment, all protective clothing should be disposed of in the same manner as the PVC gloves after sampling is completed at each site.

Never sample without a thorough risk assessment and take all necessary safety precautions.

October, 1985
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